Traumatizing Oneself—Deep Wrist Injuries Self-Inflicted with Suicidal Intention are Associated with More Severe PTSD Symptomatology than Similar Injuries from Accidents

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Abstract: Objective As suicide attempts by definition entail at least some threat to physical integrity and life, they theoretically qualify as an A1 criterion for posttraumatic stress disorder (PTSD). This study uses the unique opportunity of deep wrist injuries to quantify the effect of intentionality on PTSD rates by comparing suicide attempt survivors with patients who sustained accidental injuries similar in mechanism, localization, and extent. Method Patients who had been admitted with an acute deep wrist injury from 2008 to 2016 filled out the revised Impact of Event Scale and reported other known PTSD risk factors. Mental morbidity and intentionality of the injury were determined by psychiatric consultation during the index hospitalization. Results Fifty-one patients were followed up (72.5% male, 92.2% Caucasian, mean age at injury 42.3 ± 17.5 years, 72.5% accidental injuries), on average 4.2 ± 2.9 years after their injury. The intentionality of the injury alone predicted the severity of intrusions, avoidance, hyperarousal, and probable PTSD (aOR = 14.0). Conclusions Traumatization in the context of a suicide attempt may be a hitherto unknown PTSD risk factor. Patients after suicide attempts, especially medically serious attempts, should be monitored for PTSD symptoms.

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Conclusions: Traumatization in the context of a suicide attempt may be a hitherto unknown PTSD risk factor. Patients after suicide attempts, especially medically serious attempts, should be monitored for PTSD symptoms.

Every year, 4‰ of the adult world population attempts suicide (World Health Organization, 2014), which is defined as "a potentially self-injurious behavior associated with at least some intent to die" (Turecki & Brent, 2016). The majority of persons attempting suicide

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poison themselves or cut their wrists (Asnis et al., 1993; Buron et al., 2016; Gysin-Maillart, Schwab, Soravia, Megert, & Michel, 2016; Oh et al., 2014; Stanley, Hom, Boffa, Stage, & Joiner, 2019), which more than 98% survive (Mergl et al., 2015; Spicer & Miller, 2000; Yip et al., 2012). Needless to say that these survivors are in urgent need of empathic and evidence-based aftercare. However, while the risk of repetition has been intensely studied (Beghi, Rosenbaum, Cerri, & Cornaggia, 2013), other possible psychological sequelae of suicide attempts have received little scientific attention, such as the development of posttraumatic stress disorder (PTSD).

Recently, Stanley, Boffa, and Joiner (2019) noted that a suicide attempt by definition entails at least some threat to physical integrity and life and therefore theoretically qualifies as an A1 criterion for PTSD (American Psychiatric Association, 2013). So far, there are only two empirical studies addressing this question, which have found suicide attempt-related PTSD (saPTSD) in 46.7% and 27.5% of cases, respectively (Bill et al., 2012; Stanley, Hom, et al., 2019). Additionally, Bill et al. (2012) found saPTSD to be specifically connected to the suicide attempt, as it had no association with other traumatic events or the habitual coping style. However, these previous studies neither focused on a specific method of attempting suicide nor included a control group, disallowing any comparisons of the rate of saPTSD with PTSD rates after other types of traumatization.

This critique points to the great methodological challenge involved in studying saPTSD: The scientific gold standard, experimental manipulation, is obviously not feasible. The next best option is observational studies using adequate control groups, which should consist of patients suffering comparable physical injuries outside of a suicide attempt. Most injuries from suicide attempts, such as poisoning or gunshot wounds, also occur in the criminal context. However, being the victim of a crime is a known risk factor for PTSD in itself (Benjet et al., 2016; Shalev et al., 2019). Thus, PTSD after such an experience may result from both the experience of physical injury and the psychological experience of being victimized. To disentangle these effects, one would need to focus on a type of injury that (1) occurs in the context of both suicide attempts and accidents and (2) is relatively common. One of the few suicide attempt methods meeting these criteria is deep wrist injuries (DWIs), as they can occur both by intentionally cutting one's wrist and, for example, by falling on broken glass. DWIs therefore offer the unique opportunity to quantify the potential for suicide attempts to catalyze PTSD by direct comparison with PTSD rates after accidental injuries similar in mechanism, localization, and extent, without confounding by victimization.

STUDY POPULATION AND METHODS

Sample

The study population consisted of all patients admitted to the Clinic of Plastic Surgery, University Hospital of Schleswig-Holstein, Lübeck Campus, Germany, for acute treatment of a deep wrist injury (DWI) from 2008 to 2016. A DWI was defined as a traumatic injury to at least one deeper anatomical structure (except for the palmaris longus tendon). The exclusion criteria were an amputation, being a minor (<18 years), ten unsuccessful attempts to contact the participant for the follow-up examination, and a lack of informed consent, which applied to 132 of 183 cases.

After the start of data acquisition, one of the authors (ALW) suffered an accidental DWI. As no psychiatric data on her were gathered due to her being an accident victim and as she did not handle surgical data before anonymization, we regarded the risk of bias to be low and elected to include ALW's case in the study. As she subsequently developed PTSD, in contrast to the majority of accident victims in our study, the inclusion of her case decreased the risk of falsely rejecting the null hypothesis rather than putting our findings in question.

Study Design and Protocol

Prior to data acquisition, the study protocol was approved by the Ethics Committee of the University of Lübeck (reference number 13-054) and registered at clinicaltrials.gov with the ID NCT03038581. A detailed report has been published by Kisch et al. (2019). In short, patients gave fully informed written consent to have their administrative and clinical data used for research purposes during the index hospitalization. Later, patients with the relevant ICD-10 codes were informed about the purpose and procedure of this study by mail and phone and asked to participate in the follow-up examination. Self-infliction of the DWI was determined during the index hospitalization by psychiatric consultation, as was mental morbidity in suicide attempt survivors.

Measures

To quantify the PTSD symptomatology, we used the Impact of Events Scale (IES) (Horowitz, Wilner, & Alvarez, 1979) in its revised version (Weiss & Marmar, 1997) in a German translation (Maercker & Schützwohl, 1998). Participants were explicitly instructed to fill out the questionnaire with regard to their DWI, disregarding other traumatic events they may have experienced.

The IES-R assesses the frequency of intrusions (seven items), avoidance (eight items), and hyperarousal (seven items) in the preceding week on 4-point Likert scales (0 = "never," 1 = "rarely," 3 = "sometimes," and 5 = "often"). Adding up the values of the items yields the IES-R sum score (ε [0; 110]). A recent large-scale study found the optimally sensitive cutoff for the IES-R sum score to be 34, resulting in a sensitivity between .86 and .89 (Morina, Ehring, & Priebe, 2013). As that study used the English version of the IES-R, which has a 5-point Likert scale response format (0, 1, 2, 3, and 4) and therefore a theoretical maximum of 88, we adjusted the cutoff criterion for our study to a value of (110/88) *34 = 42.5. As the validity of aggregating the IES-R subscales has been disputed (Zilberg, Weiss, & Horowitz, 1982), Maercker and Schützwohl (1998) have proposed a formula based on regression coefficients to derive a (probable) PTSD diagnosis from IES-R subscale scores. As both strategies have their merits, we computed all analyses twice.

Operationalizations

Injuries were coded dichotomously, that is, partial and total injuries were coded in the same way. Cases with DWI on one hand and superficial injury on the other were classified as one-sided injuries. The injuring object was categorized into the following categories: cutting tools (e.g., knives, scalpels), shards (of glass, porcelain, etc.), tearing machinery or tools (e.g., circular saw, bread slicer), and thermal injuries. Educational attainment was categorized according to the International Standard Classification of Education (ISCED) (Unesco Institute for Statistics, 2012) as follows: none or primary (*Grundschule*, 4 years of education, ISCED level 1), secondary (*Hauptschule*, *Realschule*, or *Gymnasium*, 6 to 13 years of education, ISCED levels 2–4), and tertiary education (*Fachhochschule* or *Hochschule*, more than 13 years of education, ISCED levels 5 and 6).

Statistical Analyses

The post hoc power analysis was carried out using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007); all other statistical analyses were performed with SPSS version 24 for Windows (SPSS Inc., USA). We used Cronbach's alpha to assess the internal consistency of the scales (Cronbach, 1951). As the distributions of the questionnaire data were skewed, the Mann–Whitney *U*-test was used to analyze differences between groups. To conservatively estimate the importance of intentionality for PTSD symptomatology, we computed blockwise regression. Block 1 of the regression models contained known risk factors for PTSD (gender, age at injury, and seriousness of the injury [operationalized as injury to nerves or arteries and the number of tendons injured]) (Brewin, Andrews, &

Valentine, 2000). As patients may experience remission of PTSD symptoms over time, we also entered the length of the interval between injury and study participation in the 1st block. Only after the variance explained by those known predictors was removed was the intentionality of the injury entered as predictor (in the 2nd block). Thus, the reported OR for intentionality is adjusted for all other predictors (aOR). To compensate for the violation of assumptions regarding the sample distribution, resampling methods were applied where adequate (bias corrected and accelerated with 1,000 samples and the confidence level set to 95%). The post hoc power for the R^2 increase in fixed-effects multiple regression was .996 (computed for the IES-R sum score with effect size $f^2 = 0.44$ and noncentrality parameter $\lambda = 22.43$). If not otherwise stated, the results were deemed significant when the type I error probability fell below .05. As the subsample of suicide attempt survivors was relatively small, no inferential statistical analyses were carried out on the subgroup level, and descriptive analyses are presented instead.

RESULTS

Demographic and Clinical Characteristics

Fifty-one of 183 patients agreed to the follow-up examination (response rate = 27.9%). The followed up patients did not differ significantly from the other patients regarding age and employment status at the time of injury, gender, ethnicity, handedness, intentionality, or extent of the injury (all $p \geq .100$).

In the follow-up subsample, 19.7% of DWIs stemmed from suicide attempts, all of which occurred in the context of a mental disorder, such as a major depressive episode (66.6%), substance use disorder (21.2%), and/or reaction to stress (15.2%). One suicide attempt survivor had preexisting posttraumatic stress disorder (PTSD). Suicide attempt survivors did not differ significantly from accident survivors regarding gender, ethnicity, educational attainment, and handedness (all $p \geq .231$, see also Tables 1 and 2). However, suicide attempt survivors tended to be older than accident survivors (52.5 ± 15.2 years vs. 38.3 ± 16.8 years, $U = 2.55$, $p = .011$) and were less likely to be (self-) employed at the time of the injury (36.4% vs. 80.0%, $\chi^2(2) = 11.1$, $p = .004$). In all suicide attempts, the injuring object was a cutting tool, whereas accidents involved various types of objects (see Table 2).

The extent of injury in suicide attempt survivors was similar to that in accident survivors regarding the total number of anatomical structures injured and the frequency of nerve or arterial injury (all $p \leq .557$). However, suicidal DWIs were mostly localized to the nondominant radial side and accidental DWIs to the ulnar side. Additionally, suicide attempt survivors were more likely to have damage to the median nerve (see Table 2 for test statistics and Kisch et al. (2019) for further details).

Descriptive Statistics on Questionnaire Data

There were no data missing in the IES-R. The interval between injury and follow-up, the IES-R subscale scores, and the sum score were not normally distributed (all Kolmogorov–Smirnov $p \leq .035$). The global internal consistency of the IES-R was excellent (Cronbach's $\alpha = .95$), with Cronbach's α for the subscales ranging between .86 and .89.

PTSD Symptomatology

The IES-R cutoff of 42.5 identified six patients with probable PTSD among the suicide attempt survivors (42.9%) and two patients among accident survivors, 5.4%, $\chi^2(1) = 10.8$, Fisher's exact $p = .003$, Cramérs V = .460. A logistic regression model for probable PTSD with the predictors gender, age at injury, injury to nerves, injury to arteries, number of tendons injured, length of the interval between injury and study participation did not fit the data better than the null model, $\chi^2(6) = 11.35$, $p = .078$. The addition of the intentionality of the injury as a predictor in the 2nd block led to a significant increase in the amount of the variance explained, $\chi^2(1) = 6.09$, Cox and

TABLE 1
Demographic Characteristics of the Follow-up Sample

	Cause of injury			
N	All 51	Accident 37	Suicide attempt 14	Test statistic
Age at injury [years], *M* (± *SD*)	42.3 (± 17.5)	38.3 (± 16.8)	52.5 (± 15.2)	$U = 2.55, p = .011$
Gender				
Male (%)	72.5	75.7	64.3	n.s.
Female (%)	27.5	24.3	35.7	
Handedness (%)				
Right-handed (%)	88.0	88.9	85.7	n.s.
Left-handed (%)	12.0	11.1	14.3	
Ethnicity (%)				
Caucasian (%)	92.2	89.2	100.0	n.s.
Asian (%)	7.9	10.8	0.0	
Educational attainment (%)				
None or primary (%)	5.9	2.7	14.3	n.s.
Secondary (%)	80.4	81.1	78.6	
Tertiary (%)	13.7	16.2	7.1	
Employment status at injury				
(Self-)employed	69.6	80.0	36.4	$\chi^2(2) = 11.1, p = .004$
Unemployment benefits or invalid pension (%)	15.2	5.7	45.5	
Old-age pension (%)	15.2	14.3	18.2	

n.s., not significant.
Test statistic refers to the comparison of accident survivors and suicide attempt survivors.

Snell's $\Delta R^2 = .090$, Nagelkerke's $\Delta R^2 = .155$, $p = .014$, and intentionality was the only significant predictor of probable PTSD (Wald = 5.0, $p = .025$, aOR = 14.0). An analogous regression using the estimation equation proposed by Maercker and Schützwohl (1998) to determine probable PTSD could not be computed because probable PTSD cases occurred only in suicide attempt survivors, a situation known as quasi-complete separation in the data (Heinze, 2006).

Descriptive statistics for the IES-R subscales and sum score are given in Table 3 and Figure 1. To quantify the effect of intentionality of the DWI on the severity of subsequent PTSD symptomatology, we conducted a blockwise regression on the IES-R sum score with the above-mentioned predictors in the 1st block. This model did not fit the data better than the null model, $F(7, 43) = 1.60$, $p = .162$. The addition of intentionality of the injury as a predictor in the 2nd block led to a significant increase in the amount of the variance explained ($\Delta R^2_{corr} = .24$, $\Delta F = 16.2$, $p < .001$), and intentionality was the only significant predictor of PTSD (ß = .529, $T = 4.03$, $p < .001$). Analogous regression models for the IES-R subscales yielded similar results (see Table 4).

The only suicide attempt survivor that had preexisting PTSD showed saPTSD symptomatology below the cutoff (IES-R sum score = 25). Among suicide attempt survivors with major depressive episodes at the time of the attempt, five out of nine developed saPTSD (56%). In contrast, only one out of four suicide attempt survivors without major depressive episodes at the time of the attempt developed saPTSD (25%).

DISCUSSION

In our study, deep wrist injuries (DWIs) self-inflicted with suicidal intention were associated with more posttraumatic stress disorder

TABLE 2
Clinical Characteristics of the Follow-up Sample

	Cause of deep wrist injury			
N	All 51	Accident 37	Suicide attempt 14	Test statistic
Interval between injury and follow-up [years], *M* (± *SD*)	4.2 (± 2.9)	4.4 (± 2.7)	3.8 (± 3.2)	n.s.
Injuring object				
Cutting tool (%)	44.7	25.7	100.0	$\chi^2(3) = 20.0, p < .001$
Shard (%)	38.3	51.4	0.0	
Tearing machinery or tool (%)	10.6	14.3	0.0	
Other (%)	6.4	8.6	0.0	
Injured side				
Only dominant hand (%)	28.0	33.3	14.3	$\chi^2(2) = 11.7, p = .003$
Only nondominant hand (%)	64.0	66.7	57.1	
Both hands (%)	8.0	0.0	28.6	
Extent of injury				
Number of injured structures, *M* (± *SD*)	4.7 (± 4.7)	4.4 (± 4.1)	5.6 (± 6.1)	n.s.
Radial artery (%)	25.5	21.6	35.7	n.s.
Ulnar artery (%)	29.4	32.4	21.4	n.s.
Any artery (%)	51.0	51.4	50.0	n.s.
Median nerve (%)	33.3	24.3	57.1	$\chi^2(1) = 4.9$, Fisher's exact $p = .045$
Ulnar nerve (%)	19.6	24.3	7.1	n.s.
Superficial branch of radial nerve (%)	17.6	21.6	7.1	n.s.
Any nerve (%)	64.7	64.9	64.3	n.s.
Any superficial flexor tendon (%)	41.2	45.9	28.6	n.s.
Any profound flexor tendon (%)	29.4	32.4	21.4	n.s.
Any tendon (%)	78.4	78.4	78.6	n.s.

n.a., not applicable; n.s., not significant.
Test statistic refers to the comparison of accident survivors and suicide attempt survivors.

(PTSD) symptomatology than accidental injuries similar in mechanism, localization, and extent. This was true for the sum score of the revised Impact of Events Scales (IES-R), the scores on the subscales for intrusion, avoidance, and hyperarousal, and for a probable PTSD diagnosis (42.9% vs 5.4%).

The mean IES-R sum score in our accidental DWI group was roughly comparable to data from Jaquet et al. (2005),[1] demonstrating low PTSD symptomatology several years after accidental DWIs. In contrast, nearly half of the patients after DWI with suicidal intention had probable PTSD at the time of follow-up. Stanley, Hom et al. (2019), and Bill et al. (2012) found similar rates of suicide attempt-associated PTSD (saPTSD, 27.5% and 46.7%), speaking to the validity of our findings. Thus, traumatization in the context of a suicide attempt may be a hitherto unknown risk factor for PTSD (OR = 14.0).

These results may seem counterintuitive at first glance because loss of control is an essential characteristic of traumatization, whereas suicide attempts are by definition

[1]Limitations to the reliability of this conclusion are the different follow-up lengths (four vs. 10 years on average), the use of different versions of the IES (revised vs. original), and the use of a heterogeneous sample by Jaquet et al (although it predominantly consisted of accidental DWIs).

TABLE 3
Prevalence and Severity of PTSD Symptomatology and Probable PTSD Associated with Deep Wrist Injury

	Cause of injury			
N	All 51	Accident 37	Suicide attempt 14	Test statistic
IES-R				
Intrusion subscale ($M \pm SD$)	5.65 ± 7.17	3.19 ± 5.41	12.14 ± 7.35	$Z = 3.96, p < .001$
Avoidance subscale ($M \pm SD$)	5.20 ± 7.70	2.76 ± 5.28	11.64 ± 9.43	$Z = 4.17, p < .001$
Hyperarousal subscale ($M \pm SD$)	5.39 ± 7.42	2.81 ± 5.11	12.21 ± 8.39	$Z = 4.03, p < .001$
Sum score ($M \pm SD$)	16.24 ± 20.67	8.76 ± 14.21	36.00 ± 22.46	$Z = 4.29, p < .001$
Probable $PTSD_{sum\ score}$ (%)	15.7	5.4	42.9	$\chi^2(1) = 10.8$, Fisher's exact $p = .003$
Probable $PTSD_{estimation\ equation}$ (%)	7.8	0.0	28.6	$\chi^2(1) = 11.5$, Fisher's exact $p = .004$

Test statistic refers to the comparison of accident survivors and suicide attempt survivors. Probable PTSD was defined as an IES-R sum score of 42.5 or higher (adapted from Morina et al., 2013), or as the estimation equation yielding a positive value (Maercker & Schützwohl 1998), respectively. IES-R, revised Impact of Events Scale; PTSD, posttraumatic stress disorder; *Z*, standardized test statistic of the Mann–Whitney *U*-test.

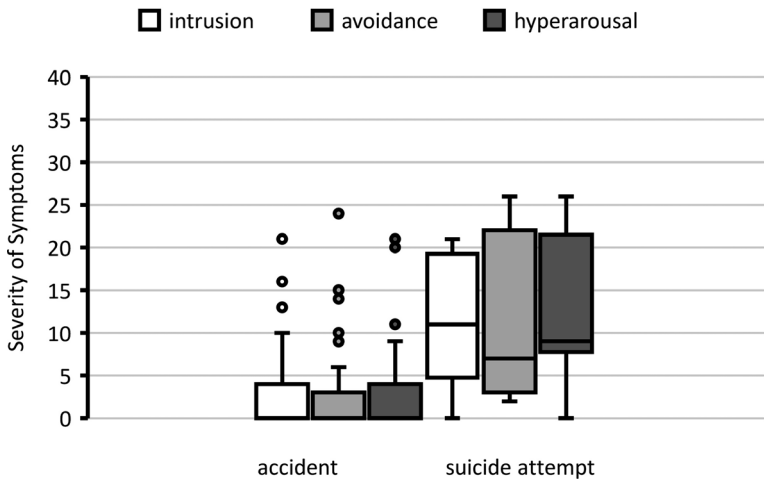

Figure 1. Severity of PTSD symptomatology, depending on the intentionality of the injury. Presented are results for the IES-R subscales intrusion, hyperarousal (theoretical maxima: 35), and avoidance (theoretical maximum: 40). IES-R, revised impact of events scale; PTSD, posttraumatic stress disorder.

self-inflicted, that is, within the control of the individual. However, we hypothesize that this holds true only for the initiation of the suicide attempt, for example, getting a knife from the kitchen. The physiological reactions to having one's wrist cut, however, are both outside the control of the person attempting suicide and difficult to anticipate for the layperson. For example, a person attempting suicide by DWI may expect rapid loss of consciousness due to massive blood loss, which in reality is rarely the case due to reflective vasoconstriction (Lam, Chesebro, & Fuster, 1988). Additionally, a person attempting suicide will

TABLE 4
Regression Models for the IES-R Subscale and Sum Scores

Criterion	R^2_{corr}	ΔF	$p_{\Delta F}$	ß
Intrusion subscale				
Model 1	.02	1.16	.346	n.a.
Model 2	.26	14.99	< .001	.529
Avoidance subscale				
Model 1	.07	1.54	.180	n.a.
Model 2	.23	9.75	.003	.436
Hyperarousal subscale				
Model 1	.07	1.57	.172	n.a.
Model 2	.30	14.61	< .001	.510
Sum score				
Model 1	.08	1.60	.162	n.a.
Model 2	.32	16.23	< .001	.529

ß, standardized regression coefficient of intentionality of the injury; n.a., not applicable.

Model 1 contained the following predictors: gender, age at injury, injury of nerves, injury of arteries, number of tendons injured, length of interval between injury, and study participation. Model 2 included the predictors in model 1 in the 1st block and intentionality of the injury as predictor in the 2nd block.

most likely anticipate pain comparable to, for example, accidentally cutting her finger while chopping vegetables. However, two-thirds of suicide attempts by DWI involve nerve injury (Kisch et al., 2019), which causes more severe and qualitatively different pain as it entails not only a nociceptive but also a neuropathic component. Additionally, as Stanley, Boffa et al. (2019) pointed out, patients may reverse their decision to end their life mid-suicide attempt and then experience that, for example, stemming the bleeding is no longer within their control. Then again, should the person attempting suicide not waiver in his resolve to die, the very fact that he survived proves that some aspect of the attempt was not under his control, for example, he was found and rescued by a stranger by pure chance. Although his survival is, of course, a good thing, a severely depressed patient may negatively interpret this as loss of control and comment on his suicide attempt along the lines of "I am a total failure; I can't even kill myself properly!".

Such a dysfunctional interpretation may persist due to deficits in cognitive reappraisal, which are common in both persons attempting suicide and persons with PTSD. Other shared vulnerability factors are social disconnectedness and deficits in problem-solving and emotion regulation (Brewin et al., 2000; Bryan, 2016; Chu et al., 2017). Therefore, in addition to safety planning and treatment of the mental disorder that led to wrist cutting, suicide attempt survivors should be monitored for PTSD symptoms. This is of special importance as saPTSD seems to be associated with suicidal intention independently of depression (Stanley, Hom, et al., 2019). Preliminary considerations regarding the treatment of saPTSD have been proposed by Stanley, Boffa et al. (2019).

Regarding the putative risk factors for saPTSD, we found preliminary evidence for depression. Although the small subsample size disallowed inferential statistical analysis, a major depressive episode at the time of the suicide attempt was associated with twice the rate of saPTSD. This is in accordance with studies finding an increased risk of development of PTSD after trauma in persons with preexisting major depressive disorder (Breslau, Davis, Peterson, & Schultz, 1997; Digangi et al., 2013). Other known PTSD risk factors, such as gender (Brewin et al., 2000), did not predict PTSD in our study, which is in accordance with the study by Stanley, Hom et al. (2019). Whether these results are false negatives due to small sample sizes or whether known risk factors for PTSD in general do not apply to saPTSD must be answered by future studies.

Strengths and Limitations

The strengths of this study are the study design as full census and the assessment of and statistical control for a variety of known PTSD risk factors, such as gender, age at injury, and the seriousness of the injury. Additionally, our study is the first on saPTSD to include a control group. Our study population seems to be representative of survivors of suicide attempts by DWI, as the

predominance of male gender, mood disorders and substance use disorders, and unilateral injuries in self-inflicted DWIs was also found in other studies (Blasco-Fontecilla, Rodrigo-Yanguas, Giner, Lobato-Rodriguez, & De Leon, 2016; Buron et al., 2016; Fujioka, Murakami, Masuda, & Doi, 2012). However, our study has some important limitations. First, selection bias is possible because patients with PTSD might have declined to participate in the follow-up examination to avoid the hospital setting as a potential flashback trigger. Second, we used a self-report questionnaire for PTSD symptoms, resulting in lower reliability of the findings than using a validated structured interview such as the SCID. Third, we did neither assess trauma therapy received between the injury and follow-up nor the PTSD risk factors previous traumatization and family history of mental disorders (Brewin et al., 2000).

Future Research

The effect of intentionality on PTSD rates reported here may be due to a higher incidence or lower remission rates in suicide attempt survivors, which could be clarified by longitudinal studies. A replication of our study design in another population, another culture, and/or focusing on another suicide attempt method would be useful to assess the generalizability of our findings. For example, 16% of burns requiring hospitalization in Iran are self-inflicted with suicidal intention (Saadati, Azami-Aghdash, Heydari, Derakhshani, & Rezapour, 2019), and a recent meta-analysis estimates PTSD rates after burns to be between 2% and 40% (Giannoni-Pastor, Eiroa-Orosa, Fidel Kinori, Arguello, & Casas, 2016). However, no studies on PTSD rates after self-immolation have been published thus far.

Also, our study could not determine whether the effect of suicidal intention on PTSD rates is independent of mental ill-health, which is an already established PTSD risk factor. To differentiate these effects, one could use a control group consisting of accident survivors with previous and/or current mental disorders. Additionally, future studies should include a third group with other-inflicted injuries, such as homicidal immolations or DWIs as defense wounds from stabbing, to directly compare the effect of self-traumatization with victimization.

CONCLUSION

Deep wrist injuries that are self-inflicted with suicidal intention have the potential to catalyze the development of PTSD. Furthermore, suicidal intention may be a hitherto unknown risk factor for PTSD following injuries. Therefore, patients after suicide attempts, especially medically serious suicide attempts, should be monitored for PTSD in addition to safety planning and the treatment of mental disorders.

AUTHOR CONTRIBUTIONS

TK, US, FS, PM, and ALW contributed to the conception and design of the study. TK and AW programmed the data acquisition interface. NM, TK, and ALW searched for cases, acquired the data, and organized the databases. AW matched and pseudonymized the cases as an independent trustee. ALW performed the statistical analysis and wrote the first draft of the manuscript. All authors contributed to the manuscript revision and read and approved the submitted version.

REFERENCES

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders (dsm-5®)* (5th ed.). Arlington, VA: American Psychiatric Association.

Asnis, G. M., Friedman, T. A., Sanderson, W. C., Kaplan, M. L., van Praag, H. M., & Harkavy-Friedman, J. M. (1993). Suicidal behaviors in adult psychiatric outpatients, i: Description and

prevalence. *American Journal of Psychiatry*, *150*, 108–112.

BEGHI, M., ROSENBAUM, J. F., CERRI, C., & CORNAGGIA, C. M. (2013). Risk factors for fatal and nonfatal repetition of suicide attempts: A literature review. *Neuropsychiatric disease and treatment*, *9*, 1725–1736.

BENJET, C., BROMET, E., KARAM, E. G., KESSLER, R. C., MCLAUGHLIN, K. A., RUSCIO, A. M., ET AL. (2016). The epidemiology of traumatic event exposure worldwide: Results from the world mental health survey consortium. *Psychological Medicine*, *46*, 327–343.

BILL, B., IPSCH, L., LUCAE, S., PFISTER, H., MARAGKOS, M., ISING, M., ET AL. (2012). Attempted suicide related posttraumatic stress disorder in depression - an exploratory study. *Suicidology*, *3*, 138–144.

BLASCO-FONTECILLA, H., RODRIGO-YANGUAS, M., GINER, L., LOBATO-RODRIGUEZ, M. J., & DE LEON, J. (2016). Patterns of comorbidity of suicide attempters: An update. *Current Psychiatry Reports*, *18*, 93.

BRESLAU, N., DAVIS, G. C., PETERSON, E. L., & SCHULTZ, L. (1997). Psychiatric sequelae of posttraumatic stress disorder in women. *Archives of General Psychiatry*, *54*, 81–87.

BREWIN, C. R., ANDREWS, B., & VALENTINE, J. D. (2000). Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. *Journal of Consulting and Clinical Psychology*, *68*, 748–766.

BRYAN, C. J. (2016). Treating PTSD within the context of heightened suicide risk. *Current Psychiatry Reports*, *18*, 73.

BURON, P., JIMENEZ-TREVINO, L., SAIZ, P. A., GARCIA-PORTILLA, M. P., CORCORAN, P., CARLI, V., ET AL. (2016). Reasons for attempted suicide in Europe: Prevalence, associated factors, and risk of repetition. *Archives of Suicide Research*, *20*, 45–58.

CHU, C., BUCHMAN-SCHMITT, J. M., STANLEY, I. H., HOM, M. A., TUCKER, R. P., HAGAN, C. R., ET AL. (2017). The interpersonal theory of suicide: A systematic review and meta-analysis of a decade of cross-national research. *Psychological Bulletin*, *143*, 1313–1345.

CRONBACH, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*, 297–334.

DIGANGI, J. A., GOMEZ, D., MENDOZA, L., JASON, L. A., KEYS, C. B., & KOENEN, K. C. (2013). Pretrauma risk factors for posttraumatic stress disorder: A systematic review of the literature. *Clinical Psychology Review*, *33*, 728–744.

FAUL, F., ERDFELDER, E., LANG, A. G., & BUCHNER, A. (2007). G*power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*, 175–191.

FUJIOKA, M., MURAKAMI, C., MASUDA, K., & DOI, H. (2012). Evaluation of superficial and deep self-inflicted wrist and forearm lacerations. *The Journal of Hand Surgery – American*, *37*, 1054–1058.

GIANNONI-PASTOR, A., EIROA-OROSA, F. J., FIDEL KINORI, S. G., ARGUELLO, J. M., & CASAS, M. (2016). Prevalence and predictors of posttraumatic stress symptomatology among burn survivors: A systematic review and meta-analysis. *Journal of Burn Care Research*, *37*, e79–e89.

GYSIN-MAILLART, A., SCHWAB, S., SORAVIA, L., MEGERT, M., & MICHEL, K. (2016). A novel brief therapy for patients who attempt suicide: A 24-months follow-up randomized controlled study of the attempted suicide short intervention program (ASSIP). *PLoS Med*, *13*, e1001968.

HEINZE, G. (2006). A comparative investigation of methods for logistic regression with separated or nearly separated data. *Statistics in Medicine*, *25*, 4216–4226.

HOROWITZ, M., WILNER, N., & ALVAREZ, W. (1979). Impact of event scale: A measure of subjective stress. *Psychosomatic Medicine*, *41*, 209–218.

JAQUET, J. B., VAN DER JAGT, I., KUYPERS, P. D., SCHREUDERS, T. A., KALMIJN, A. R., & HOVIUS, S. E. (2005). Spaghetti wrist trauma: Functional recovery, return to work, and psychological effects. *Plastic and Reconstructive Surgery*, *115*, 1609–1617.

KISCH, T., MATZKEIT, N., WALDMANN, A., STANG, F., KRAMER, R., SCHWEIGER, U., ET AL. (2019). The reason matters: Deep wrist injury patterns differ with intentionality (accident versus suicide attempt). *Plastic and Reconstructive Surgery - Global Open*, 7, e2139.

LAM, J. Y., CHESEBRO, J. H., & FUSTER, V. (1988). Platelets, vasoconstriction, and nitroglycerin during arterial wall injury. A new antithrombotic role for an old drug. *Circulation*, *78*, 712–716.

MAERCKER, A., & SCHÜTZWOHL, M. (1998). *Erfassung von psychischen belastungsfolgen: Die impact of event skala-revidierte version (ies-r)*. Diagnostica.

MERGL, R., KOBURGER, N., HEINRICHS, K., SZEKELY, A., TOTH, M. D., COYNE, J., ET AL. (2015). What are reasons for the large gender differences in the lethality of suicidal acts? An epidemiological analysis in four European countries. *PLoS ONE*, *10*, e0129062.

MORINA, N., EHRING, T., & PRIEBE, S. (2013). Diagnostic utility of the impact of event scale-revised in two samples of survivors of war. *PLoS ONE*, *8*, e83916.

OH, S. H., LEE, K. U., KIM, S. H., PARK, K. N., KIM, Y. M., & KIM, H. J. (2014). Factors associated with choice of high lethality methods in suicide attempters: A cross-sectional study. *International Journal of Mental Health Systems*, *8*, 43.

SAADATI, M., AZAMI-AGHDASH, S., HEYDARI, M., DERAKHSHANI, N., & REZAPOUR, R. (2019). Self-immolation in Iran: Systematic review and

meta-analysis. *Bulletin of Emergency and Trauma*, 7, 1–8.

Shalev, A. Y., Gevonden, M., Ratanatharathorn, A., Laska, E., van der Mei, W. F., Qi, W., et al. (2019). Estimating the risk of PTSD in recent trauma survivors: Results of the international consortium to predict PTSD (ICPP). *World Psychiatry*, *18*, 77–87.

Spicer, R. S., & Miller, T. R. (2000). Suicide acts in 8 states: Incidence and case fatality rates by demographics and method. *American Journal of Public Health*, *90*, 1885–1891.

Stanley, I. H., Boffa, J. W., & Joiner, T. E. (2019). PTSD from a suicide attempt: Phenomenological and diagnostic considerations. *Psychiatry*, *82*, 57–71.

Stanley, I. H., Hom, M. A., Boffa, J. W., Stage, D. L., & Joiner, T. E. (2019). PTSD from a suicide attempt: An empirical investigation among suicide attempt survivors. *Journal of Clinical Psychology*, *75*, 1879–1895.

Turecki, G., & Brent, D. A. (2016). Suicide and suicidal behaviour. *Lancet*, *387*, 1227–1239.

UNESCO Institute for Statistics. (2012). *International standard classification of education: ISCED 2011. (9789291891238)*. Montreal, QC: UNESCO Institute for Statistics.

Weiss, D., & Marmar, C. (1997). The impact of events scale—revised. In J. Wilson, & T. Keane (Eds.), *Assessing psychological trauma and PTSD* (pp. 399–411). New York: Guilford.

World Health Organization (2014). *Preventing suicide: A global imperative*. Geneva, Switzerland: World Health Organization.

Yip, P. S., Caine, E., Yousuf, S., Chang, S. S., Wu, K. C., & Chen, Y. Y. (2012). Means restriction for suicide prevention. *Lancet*, *379*, 2393–2399.

Zilberg, N. J., Weiss, D. S., & Horowitz, M. J. (1982). Impact of event scale: A cross-validation study and some empirical evidence supporting a conceptual model of stress response syndromes. *Journal of Consulting and Clinical Psychology*, *50*, 407.

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